

Robotic Mission Simulation Tool, Phase I

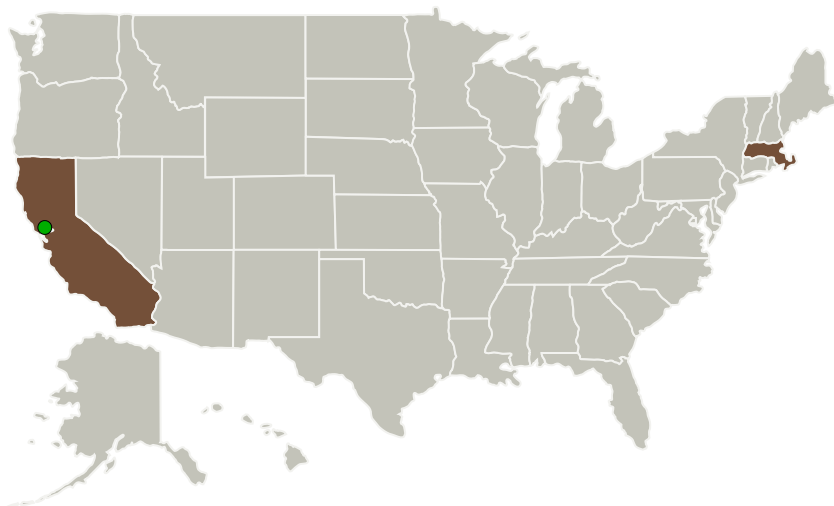
Completed Technology Project (2013 - 2013)



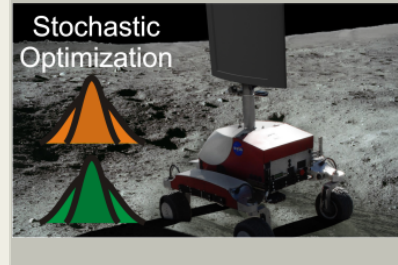
Project Introduction

Energid Technologies proposes a software tool to predict robotic mission performance and support supervision of robotic missions even when environments and situations are profoundly unknown. It transcends common Monte Carlo simulations by supporting input parameters for which probability distributions are not available. Stochastic optimization is combined with randomized simulation to bound statistical measures of performance and convey the parameters giving the extreme scenarios. It also provides 3D immersive presentation of those scenarios. The act of performing multiple simulation runs in real time is enabled by the fast simulation capability provided by Energid Technologies' existing software combined with the development of new algorithms and software. The new algorithms cover path planning, scene rendering, sensor modeling, and robot-terrain interaction modeling. In the new software, automatic path planning is calculated using a combination of static and dynamic techniques. Scene rendering for sensor modeling is implemented using fast ray tracing for low-update-rate sensors and ray-tracing-validated rasterization for fast-update-rate sensors. Robot-terrain interaction is calculated through particle simulations implemented on graphics cards. For maximum performance, the new software allows distribution of randomized simulation runs over multiple networked PCs and cloud-based clusters. This combination of fast algorithms and statistical optimization offers a tool that provides new engineering insights and data. The software will be demonstrated on the example mission of searching for ice near the southern lunar pole, giving evidence of the ability of the tool to support challenging relevant missions.

Primary U.S. Work Locations and Key Partners



Stochastic Optimization



Robotic Mission Simulation Tool

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Organizations Performing Work	Role	Type	Location
Energid Technologies	Lead Organization	Industry	Cambridge, Massachusetts
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

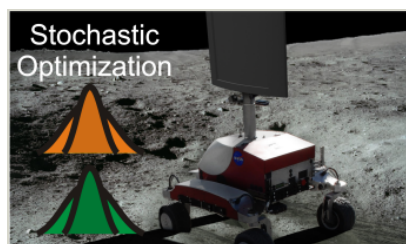
Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

**May 2013:** Project Start**November 2013:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/138465>)

Images

**Project Image**

Robotic Mission Simulation Tool
(<https://techport.nasa.gov/image/131801>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Energid Technologies

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

James D English

Co-Investigator:

James English

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Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX04 Robotic Systems
 - └ TX04.6 Robotics Integration
 - └ TX04.6.2 Modeling and Simulation for Robots

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System